funds, or annuities are wont to make such cities their permanent places of residence in their declining years. On the other hand, it is, for the most part, large industrial areas (like Gary, Birmingham, Detroit, Flint, and Akron, for example) which, in their rapid growth, and because of the opportunities that their industries offer, have attracted the young and vigorous in search of remunerative employment. —*Statistical Bulletin, Metropolitan Life Insurance Company.*

Per Cent of Population at Ages 65 and Over, In Certain Cities of the United States with a Total Population of 100,000 or More in 1930; Compared with Corresponding Percentages for the Same Cities in 1900, 1910 and 1920

City	Per Cent of Population at Ages 65 and Over			
	1930	1920	1910	1900
Long Beach, Calif.	9.2	10.9	....	....
San Diego, Calif.	9.1	9.2	7.8	....
Spokane, Wash.	7.0	4.6	2.6	1.9
Denver, Colo.	6.9	4.9	3.6	2.8
Portland, Ore.	6.6	4.7	3.2	2.5
Los Angeles, Calif.	6.2	6.2	4.8	4.4
Oakland, Calif.	6.1	5.2	4.9	5.0
Boston, Mass.	5.5	4.4	4.0	3.6
San Francisco, Calif.	5.4	4.3	3.8	4.0
Salt Lake City, Utah	5.2	4.0	3.3	3.8
St. Louis, Mo.	5.2	4.2	3.6	3.3
Philadelphia, Pa.	5.1	4.2	4.0	3.8
Miami, Fla.	4.5	3.4	....	....
New Orleans, La.	4.1	3.7	3.8	3.8
Chicago, Ill.	4.0	3.2	2.8	2.4
New York, N. Y.	3.8	3.1	2.8	2.8
Chattanooga, Tenn.	3.3	3.0	2.8	2.3

CARBON MONOXIDE HAZARDS IN TRAFFIC ACCIDENTS IN CALIFORNIA

The Industrial Hygiene Service of the California State Department of Public Health, Dr. John P. Russell, Chief, has issued a preliminary report covering the carbon monoxide hazard in relation to California highway traffic casualties. Doctor Russell was assisted in making the survey of such hazards by Sergeant George S. Zelk, Bureau of Commercial Equipment, California Highway Patrol, and Fred R. Ingram, Senior Engineer, Industrial Hygiene Service, California State Department of Public Health.

In 1937, out of 37,968 traffic accidents on California highways, 597 were attributed officially to "sleepiness" of the drivers of the vehicles involved. It is admitted that fatigue due to long hours of driving and insufficient rest contributes to sleepiness and the theory that the inhalation of engine exhaust gases is responsible in part at least for otherwise inexplicable accidents led to the making of the survey.

Determinations of carbon monoxide in drivers' compartments of motor vehicles were made in nine widely scattered areas of California. This work was conducted on ascending and descending grades, as well as on level highways, under varying weather conditions, including snow, rain and desert heat, at various hours of the day and night, in temperatures ranging from 21 degrees to 74 degrees Fahrenheit, and relative humidities ranging from 18 per cent to 97 per cent.

Most of the vehicles tested were trucks and busses, for the reason that they all fall into the industrial hygiene classification. At a later time, under other auspices, similar tests on passenger cars may be undertaken.

A total of 1,105 vehicles was tested in the survey, and in 2 per cent of the vehicles tested the carbon monoxide concentration was found to be 100 parts per million or higher. Such a concentration of carbon monoxide is sufficient, in some cases, to cause headache, sleepiness and impaired judgment, when inhaled over a period of six to eight hours. In vehicles where such high concentrations are found, potentially dangerous conditions exist, and it is essential that the source of the dangerously high concentration be discovered.

Generally, the defect was traced to one or more of the following defects in the exhaust system: loose exhaust pipe or manifold connection, blown-out exhaust gasket, cracked exhaust manifold, leaky muffler or faulty design of the exhaust system. Exhaust gases escaping from these defects may enter the driver's compartment in large quantities through openings in and around the cab without the driver being aware of their presence. Correction of defects in the exhaust system greatly reduces the amount of carbon monoxide to which the driver is exposed.

In an effort to correlate the effects of inhalation of engine exhaust gases with the ability to drive motor vehicles, five volunteers, including the writers, underwent a series of tests of their steering ability, perception and reaction time, eye-hand and eye-foot coördination, visual acuity, field of vision, depth perception, speed estimation, color vision and glare resistance, before and after the inhalation of known amounts of carbon monoxide during a four-day period.

These tests were made with the coöperation of the Division of Drivers' Licenses, State Department of Motor Vehicles, using instruments and apparatus assembled by them for measuring driving skill. The subjects were first given a series of tests on the instruments to reduce the learning or practice factor. Blood pressure and pulse readings were taken, and determinations of blood saturation with carbon monoxide by the pyrotannic acid method were made. The subjects then spent one hour in an improvised gas chamber, a closed sedan into which engine exhaust gas was introduced by means of a hose from the exhaust pipe. The concentration of carbon monoxide in the chamber, determined by the two carbon monoxide indicators used in the survey, was kept constant by admitting small amounts of exhaust gas from time to time to replace that which leaked out gradually. At the end of the period of exposure, blood samples were again tested, and driving tests were repeated. It was found that exposure to the gas had very little effect on blood pressure, pulse rate, steering ability, visual acuity, field of vision, color vision, depth perception, speed estimation or glare resistance.

The blood saturation readings are not considered reliable, due to inaccuracies in color standards which were not discovered until after the tests were made. However, they suggest that carbon monoxide when inhaled in small amounts day after day has a cumulative effect, and is not completely eliminated from the body in a few hours after exposure, as is commonly believed. Further tests along this line have been planned for the near future.

Braking time represents the interval, in hundredths of a second, elapsing between the appearance of a red light and the application of the brake by the subject, seated behind a set of standard automobile controls, following a moving road scene by manipulating the steering wheel. It was found that the inhalation of an amount of carbon monoxide considered equivalent to that breathed by the driver of a vehicle containing 100 parts per million of the gas during a six to nine hour driving period caused a diminution in driving ability as indicated by headache, muscular weakness and tremors, mental confusion, and a small but definite lengthening of braking time. It is believed that this effect is greatly increased by fatigue such as is experienced by drivers of motor vehicles, particularly heavy trucks or similar vehicles. Plans are being made to conduct further tests under conditions more closely approximating actual driving conditions in order to minimize the learning factor and to include the fatigue factor in combination with exposure to carbon monoxide.

Following are the conclusions reached by Doctor Russell as a result of this preliminary survey:

It is believed that many otherwise unexplained highway accidents, in which experienced drivers, traveling along a straight highway in broad daylight after a good night's rest, run off the road or crash head-on into an approaching vehicle, are due to the driver unknowingly breathing dangerous amounts of exhaust gases escaping from defects in the exhaust system of the vehicle he is operating.

In the absence of defects in the exhaust system, it is believed that there is little danger of carbon monoxide poisoning from engine exhaust gases while driving along the highway.

The exhaust systems of motor vehicles should be inspected carefully, and periodically, for any defects which permit the escape of exhaust gases before reaching the exhaust pipe outlet.

Such defects should be corrected immediately to protect the driver from exposure to dangerous concentrations of carbon monoxide in the escaping gases.

Drivers' compartments of motor vehicles should be fitted with tight floor mats to exclude exhaust gases which may enter through cracks around floor boards. Openings in the dash should be closed as tightly as possible.